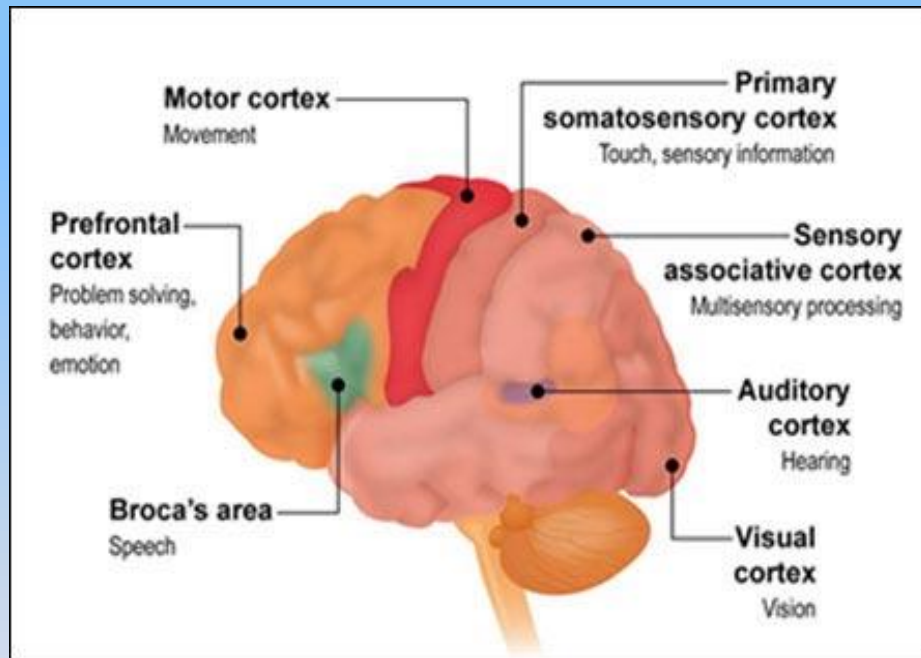


CHAPTER 2

What Brain Research Tells Us About Learner Differences

Allie Niehaus, Amanda Gruetzner, Chris Bohle

Understanding the Learning Brain



- The dense outer tissue of the brain is known as the **cortex**
- The incredible *connectivity* embedded in the networks for the cortex makes it the center of learning ability.
- Within the large networks of the cortex, there are smaller networks assigned to specific tasks.
- The three primary networks are
 - Recognition
 - Strategic
 - Affective

Primary Networks of the Brain

Strategic Networks:
Oversee mental and motor patterns and allow us to monitor actions and skills.

Recognition Networks:
Assign meaning to patterns and allow us to understand concepts and ideas.

Affective Networks:
Assign emotional significance to patterns



Characteristics of Primary Networks

1.) Processing distributed
laterally across the
brain.

- For example, this allows us to identify the size and shape of other cars around us while we are driving.

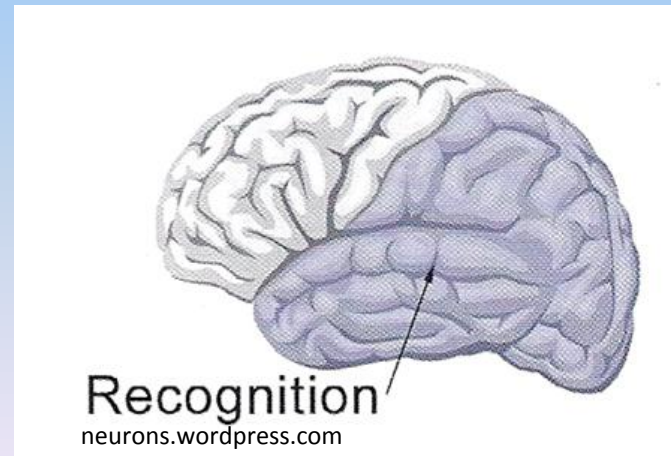
2.) Processing distributed
hierarchically

- Bottom up: sensory
information

- Top down:
contextual
information

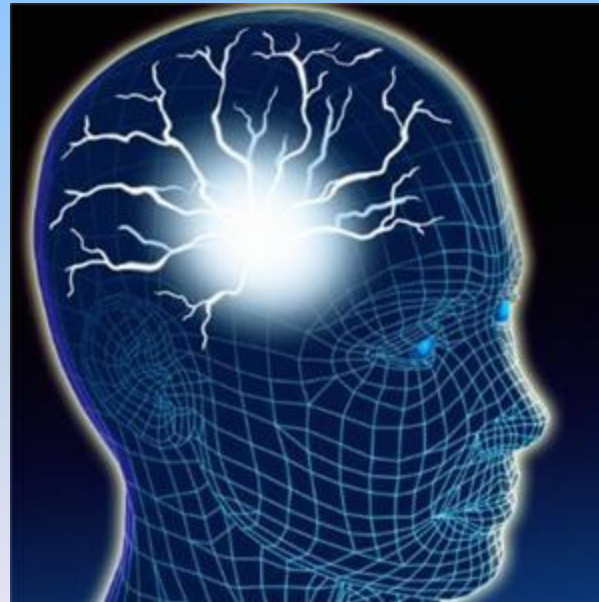
Recognition Networks

- Enable us to identify and interpret patterns of sound, light, taste, smell and touch
- The Brain is capable of processing large amounts of information and detail within a fraction of a second
- Located in the rear of the brain.



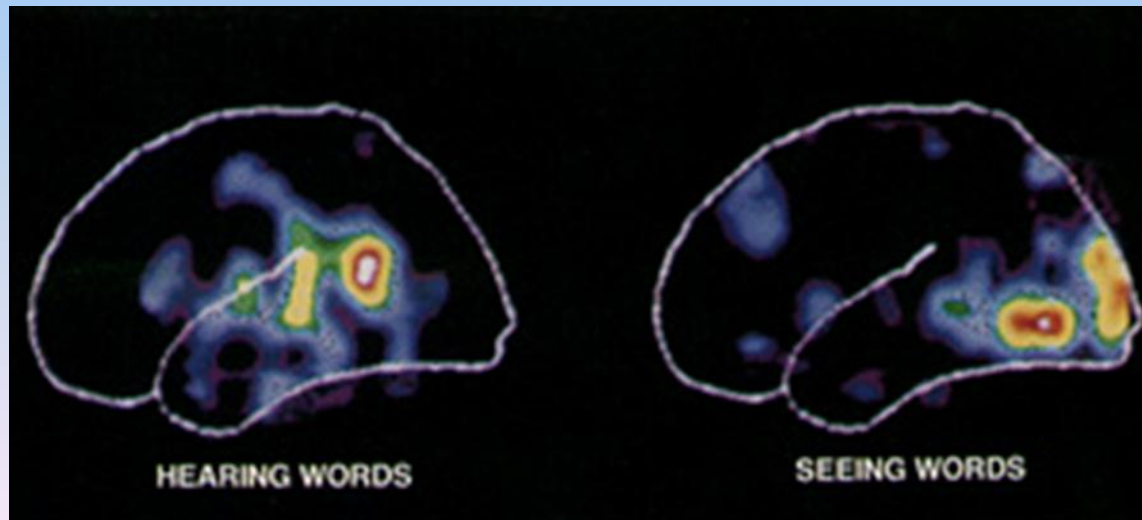
How is the brain able to process info?

- Positron Emissions Topography (PET) scans show that the within our brains, different areas, or modules, are used to process recognition.



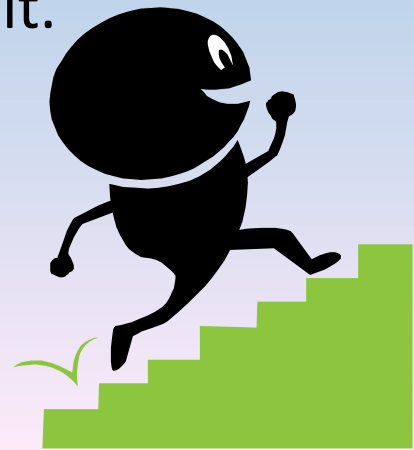
Hearing Words Vs. Seeing Words

- General tasks of recognition are distributed across different areas of the brain.
- Depicted below, auditory recognition stimulates a different area of the brain from visual recognition



Bottom-Up Processing

- Visual sensory information is taken in through the eyes, and carried to our brains
- As it is being processed it travels through a complex hierarchical network
- The information eventually reaches the visual cortex, but not before being identified by several modules of the brain
- Impedances such as poor light, low-quality photocopies, or mumbled speech can make the bottom-up processing of recognition tasks difficult.



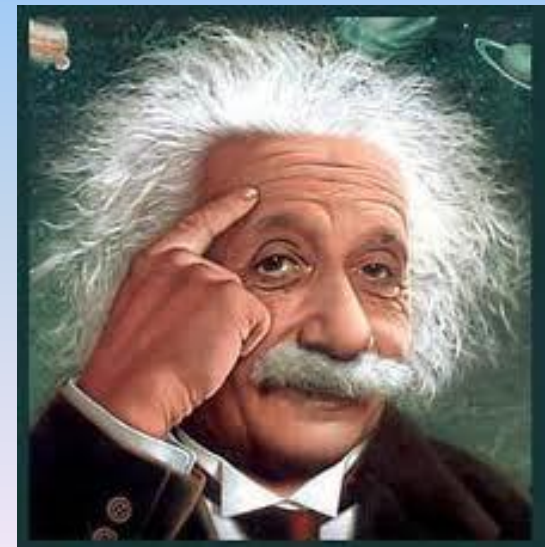
Top-Down Processing

- Our brain makes use of higher order information, such as background knowledge, context, and the overall pattern, to ease the recognition of detail.
- When we receive visual or auditory information, our brain's first try to associate previous knowledge that we have stored in our memory.



Individual Differences in Recognition Networks

- Individuals brains react to sounds and images in different ways.
- When shown visual stimuli, PET scans show increased activity in the rear of the brain, however exact location, magnitude and distribution of the increased activity vary from person to person
- These difference, although discrete, have a profound effect on the way individuals recognize things in the world



Strategic Networks

- Strategic Networking allows us to monitor our motor pattern-actions and skills. These motor-action patterns and skills can range from playing soccer to writing an essay. Strategic networking can be done both consciously or subconsciously because it is involved with *everything* we do.

Look at the following picture and try to identify who is coming into the room.



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Activity

look at the following picture and try to identify who is coming into the room.

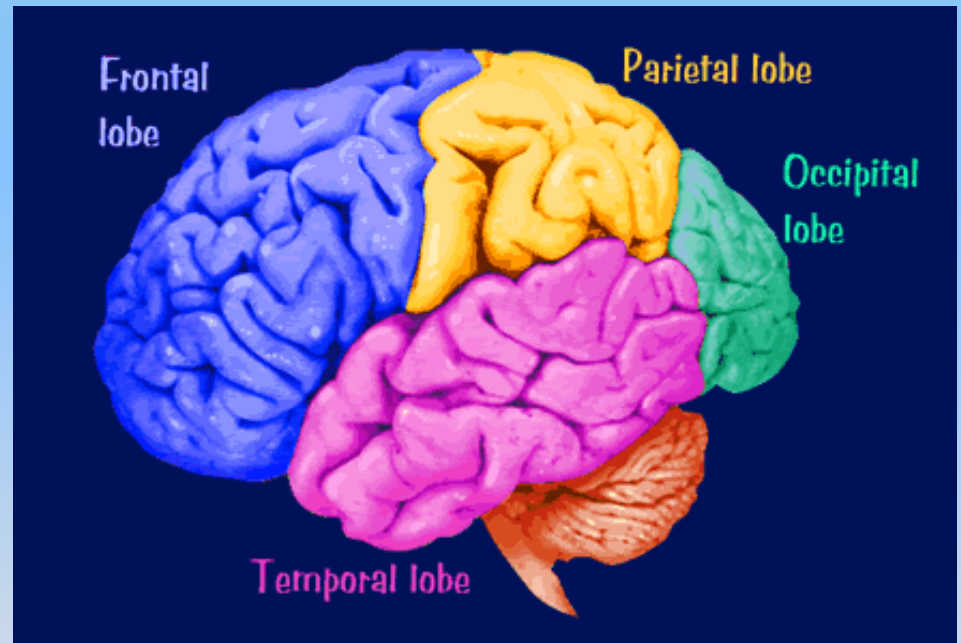


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- Within a few seconds your brains performed a multi-strategic process :
 - Identify a goal
 - Design a suitable plan
 - Executed that plan'
 - Self monitor
 - Corrected or adjusted actions

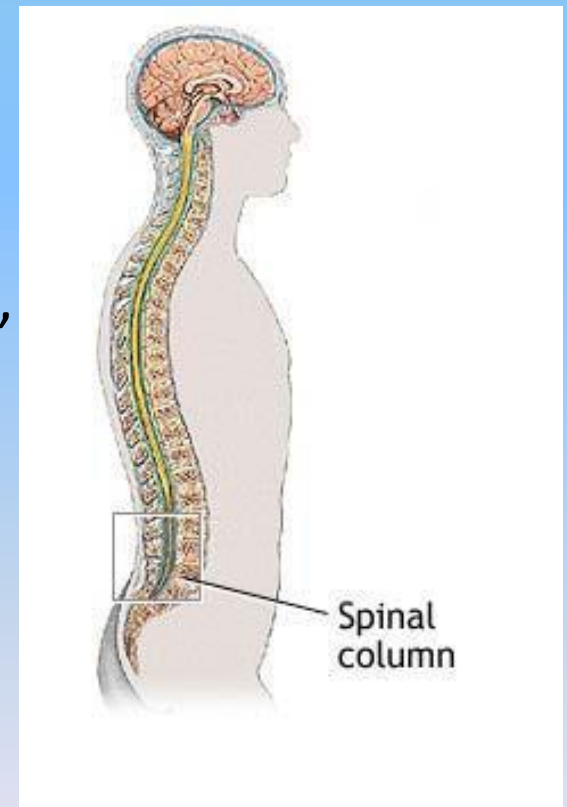
The Frontal Lobe

- Each Neural Network responsible for mental and motor action has its own realm in the human brain.
- Strategic Networking takes place in the *modules* of **Frontal Lobe**.
- Functions of the Frontal Lobe:
 - Identifying goals
 - Selecting appropriate goals
 - Self-monitoring



Top-down Processing : Strategic Networking

- **Neural signals** travel from the cortex of the brain down the spinal cord. This “command” keeps track of whether the goal is being reached.
- As the signal travels down the spinal cord, neurons that put muscle into action are found.
- This enables our internal strategies to become actions in the world around us.
- “I will pick up my toothbrush” → picking up the toothbrush



Bottom-up Processing: Strategic Networking

- A key player in bottom-up processing is the **cerebellum** which is located at the base of the brain.
- The cerebellum takes in sensory feedback which compares the action we are trying to perform to the goal intended.
- If our actions are not in rout to accomplish our desired goal, the cerebellum will inform our strategic network to correct our actions.

Individual Differences in Strategic Networking

- “learners differ dramatically in their abilities to acquire and automate pattern based routines such as forming letters, typing, spelling and multiplying.”
- A student may be skilled in organizing a plan but struggle to execute that plan. Another may be an expert in finding Information, but lack the skills to organize the information.
- Students can even favor top-down or bottom-up Processing.
- A student who can watch someone do something and then execute the action perfectly = top-down.
A student who learn best by doing the action themselves = bottom-up.



Affective Networks

- Every student learns in different ways
- There is always a certain degree of interaction with the external world
- We may even begin to see our external world differently because of the past experiences or beliefs that we have internally



Affective Networks in the Brain

- Different parts of the brain read or display emotion
- “Bottom-up” connections allow us to have emotions in response to the outside world
- Emotional Reactions

Classroom Examples

- Teacher to student observation may clarify struggles
- Intergrading student's outside interests can interest them academically



Implications for Instructors

- Every individual has their own strengths and weaknesses that affect their learning ability
- Identify personal struggles and correct them



The End

Thanks for Watching